

# Iron Absorption and Metabolism During Spaceflight

(Taken from the JSC Space Center Roundup, September 24, 1999)

It is well documented that red blood cell mass (RBCM) is decreased following space flight. Indices of tissue iron storage, however, are elevated, suggesting that the observed "anemia" is unrelated to iron availability. Iron absorption during space flight has not been determined. Whether the normal (ground-based) down-regulation of iron absorption occurs during space flight is unknown. If this level of homeostasis is indeed altered, the health implications for increased iron storage during extended duration missions are significant. If this is the case, a simple countermeasure may be implemented by altering the food system (i.e., iron intake). Limiting the intake of an element such as iron, without clear data regarding its absorption and metabolism, would not be prudent.

The primary hypothesis is that iron absorption decreases during spaceflight. This will be as a function of regulatory pathways responding to increases in iron stores and decreases in erythropoiesis. Another hypothesis to be tested is that during space flight available iron from dietary sources decreases. This decrease is insufficient to cause iron depletion in spite of an apparent microgravity-induced anemia (decrease in RBCM and hemoglobin mass) because of up-regulation of iron transport mechanisms, which maintain ferro-dynamics. We propose to determine whether iron kinetics inflight are controlled by internal cellular homeostatic mechanisms or by dietary availability. Stable isotopes of iron will be administered before, during and after spaceflight for the determination of iron absorption and kinetics. Blood samples will be collected before and after isotope administration to characterize the effects of microgravity on iron absorption, transport and storage. The role of dietary iron availability in determining ferrokinetics will also be assessed during each test period. If iron absorption is decreased then concerns about limiting dietary intake of iron could be eliminated. The availability of iron for erythropoiesis will be assessed before, during and after space flight by determination of the concentration of transferrin receptors. Because these receptors are not influenced by acute or chronic inflammatory responses as is serum ferritin, simultaneous measurement of serum proteins before, during and after space flight will separate the effects of an inflammatory response on serum ferritin from erythrokinetics. The magnitude and duration of microgravity-induced changes in hematocrit, hemoglobin, total iron binding capacity, transferrin saturation, RBC count and other indicators of ferrokinetics will also be determined. The results are expected to confirm the hypothesis and will provide a unique opportunity for the measurement of iron absorption and kinetics in microgravity. If the hypotheses are confirmed, important information will be provided for the maintenance of crew health and the development of nutritional requirements, especially for extended duration space flight.

For more information, please contact:

[Scott M. Smith, Ph.D.](#)

Life Sciences Research Laboratories/SD3  
NASA Johnson Space Center Houston, TX 77058